Solve the following algebraically

① Given $f(x) = 3x^2 - x$, find

ⓐ the slope of the curve at any point $x=a$.

ⓑ when will the slope be -16?

② $\lim_{x \to 4} \frac{\overset{2(x-4)}{2x-8}}{\sqrt{x}-2} \cdot \frac{\sqrt{x}+2}{\sqrt{x}+2}$

$\lim_{x \to 4} \frac{2\cancel{(x-4)}(\sqrt{x}+2)}{\cancel{(x-4)}} \Rightarrow$

$\lim_{x \to 4} 2(\sqrt{x}+2) \Rightarrow 2(\sqrt{4}+2) = 8$

③ $\lim_{x \to 0} \frac{\sin 2x}{4x}$

$\lim_{x \to 0} \left(\frac{1}{2} \cdot \frac{\sin 2x}{2x}\right)$

$\lim_{x \to 0} \frac{1}{2} \cdot \lim_{x \to 0} \frac{\sin 2x}{2x}$

$\frac{1}{2} \cdot 1 = \frac{1}{2}$

$$\lim_{h\to 0} \frac{f(x+h)-f(x)}{h}$$ Difference quotient

$f(x) = 3x^2 - x$

$f(x+h) = 3(x+h)^2 - (x+h)$

$$\frac{3(x+h)^2 - (x+h) - (3x^2 - x)}{h}$$

$$\lim_{h\to 0} \frac{\cancel{3x^2} + 6x\cancel{h} + 3h^{\cancel{2}} \cancel{-x} - \cancel{h} \cancel{-3x^2} \cancel{+x}}{\cancel{h}} = \lim_{h\to 0} 6x + 3h - 1$$

$= 6x - 1$

$= 6a - 1$

$m = -16$

$-16 = 6a - 1$

$-15 = 6a$

$a = -2.5$

$$\lim_{h \to 0} \frac{f(x+h) - f(x)}{h} = \text{derivative} = \underline{f'(x)}, \underline{y'}$$

f prime of x

derivative of y

y prime

$$\frac{d}{dx} f(x)$$

$$D_x[y]$$

Derivitive of y with respect to x

$$\frac{dy}{dx}$$ "d" "y" "d" "x"

$$\frac{d}{dx} f$$ "d" "d" "x" of f

$$\frac{df}{dx}$$

Derivitive:

The derivitive of the function f with respect to the variable x is the function f' whose value at x is

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$, provided the limit exists

Derivitive at a point: (alt. def.)

The derivitive of the function f at the point $x = a$ is the limit $f'(a) = \lim_{x \to a} \frac{f(x) - f(a)}{x - a}$, provided the limit exists

Find the derivative of $f(x) = \sqrt{x}$ using both methods

$$\lim_{h\to 0} \frac{\sqrt{x+h} - \sqrt{x}}{h} \cdot \frac{\sqrt{x+h} + \sqrt{x}}{\sqrt{x+h} + \sqrt{x}} = \frac{\cancel{x} + h - \cancel{x}}{h(\sqrt{x+h} + \sqrt{x})} \Rightarrow \frac{\cancel{h}}{\cancel{h}(\sqrt{x+h} + \sqrt{x})}$$

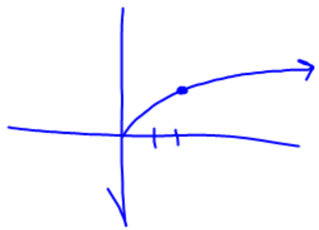
$$\lim_{h\to 0} \frac{1}{\sqrt{x+h} + \sqrt{x}} = \frac{1}{2\sqrt{x}}, \frac{\sqrt{x}}{2x}, (2\sqrt{x})^{-1}$$

$$\lim_{x\to a} \frac{\sqrt{x} - \sqrt{a}}{x-a} \cdot \frac{\sqrt{x} + \sqrt{a}}{\sqrt{x} + \sqrt{a}} = \frac{\cancel{x-a}}{\cancel{(x-a)}(\sqrt{x} + \sqrt{a})} = \frac{1}{\sqrt{x} + \sqrt{a}}$$

$$\lim_{x\to a} \frac{1}{\sqrt{x} + \sqrt{a}} = \frac{1}{2\sqrt{a}} = f'(a)$$

$f(x) = \sqrt{x}$

m at 2



$\frac{1}{2\sqrt{2}} = m$

Sect. 3.1 # Quick Review #7, 9, 10

P.S. # 1-4, 5, 7, 9, 13-19, 21, 23, 25, 26, 28